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Shortage of Water as a Constraint to Irrigation Farming at Daberam Dam Site, Northern Nigeria

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ABSTRACT

Irrigation farming the world over is currently facing serious challenges due to growing scarcity and competition for water especially in arid and semi arid regions. A number of medium and small scale irrigation projects are constrained by shortage of water which limits irrigation farming at the dam's sites. The Daberam dam located in Katsina State northern Nigeria has been facing shortage of water for ten years. This paper examines the shortage of water as a constraint to irrigation farming at the dam site. Data for the research were collected through structured questionnaire administered on the irrigation farmers and direct observation during field visit .The results have shown that a number of factors have been responsible for the shortage of water which include construction of other dams around the river basin, insufficient water discharged by streams that feed the dam, heavy silting of the dam insufficient rainfall experienced in the area. The farmers have adopted a number of measures to cope with the shortage of water which includes rationing water, digging wells, migrating to nearby dams, abandoning irrigation farming etc. The implications of the shortage include low farm productivity, physiological stress to the crops, and loss of employment opportunities. This situation has attracted the attention of the State Government that has awarded contract for the rehabilitation of the dam to be able to contain more water and establishment of agro-meteorological station to provide weather related data. The paper recommended additional measures towards improving water supply to the dam.

Keywords: *Shortage, water, constraint, irrigation farming, Daberam.*

INTRODUCTION

Water is a marvelous substance that is flowing, seeping and constantly moving from sea to land and back again. It shapes the earth's surface and moderates the climate to make life possible (Cunningham and Cunningham, 2004). Water is essential for life as it is the medium in which all living processes occur. Adejemilua (2007) observed that water is one of the most essential and important life-supporting resources. It is the foundation of life; it can even be regarded as life itself.

It is very essential for all living organisms including humans, plants and animals. For humans, water is very important both for domestic, as well as for agricultural and industrial processes (Adejemilua, 2007). The adequate quantity, good quality and sustainable supply of water are one of the key indicators for socio-economic development. Over the years, rising population, increasing industrialization and expanding agriculture has pushed up the demand for water in different parts of the world (Garg *et al*., 2007). These have led to water shortages that have continued to place great pressure on global water resources. Garg *et al* (2007), further explained that the basic reason for the shortage is the increasing demand of water due to increasing population, changing life styles and its excessive use in irrigation. Due to increasing demand, the scarcity of water is becoming more and more apparent particularly in water short countries. It is estimated that more than 30 countries of the world are already facing severe water shortages, while this number is likely to increase to more than 50 by the year 2025. The United Nations has estimated that by the year 2050, about 4 billion people will be seriously affected by shortage of water (Garg *et al*., 2007).

In order to harness the precious water resources of a country, dams are constructed across streams and rivers. The construction of a wall

type obstruction across a river helps in the storage of water upstream, forming what is known as reservoir (Garg *et al.*, 2007). The construction of dams becomes an absolute necessity in tropical countries where rainfall is seasonal falling only during a few rainy months of a year. In Nigeria, the construction of dams particularly in the north began earnestly following the effects of the Sahelian drought of 1972 – 1975 when aggravated food shortage prompted the various levels of government to embark on a rigorous policy to increase food production (Uyigue, 2006). The creation of a dam is considered as a viable way of providing sufficient water for year round irrigation for improving agricultural productivity (Ladan, 2016).

In Katsina State, a number of dams have been constructed such as the Zobe dam in 1980 and the Jibia dam in 1990 for the purpose of providing water for irrigation. Daberam dam is located between Daura and Dutsi Local Governments Areas (LGAs) in the northern part of Katsina state. The dam is owned by Katsina State Government under the management of Ministry of Agriculture and Natural Resources.

The issue of availability or shortage of water for irrigation farming has recently attracted the attention of scholars and the media particularly in Northern Nigeria. Ladan (2015) undertook a study on dam collapse and its implications on agricultural production in Kankia Katsina State. The study observed that as a result of the dam collapse, many wells and boreholes close to the dam that usually contain water before the dam collapsed, do not contain water after the collapse. This led to shortage of water supply for domestic and irrigation purposes during the dry season. Igidi (2015), reported that water scarcity has hit Sokoto State farmers around the border town of Illela where large tracks of land are unfarmed due to the scarcity of water and even those people that engage in farming most at times incur losses because the plants drop and die and even when they survive, they yield just little produce. The water scarcity has forced some young farmers to migrate to nearby Niger Republic where the Government provides water to farmers who later pay token fees after harvest (Igidi, 2015).

In the year 2016, Saddiq (2016) reported that irrigation farming is endangered in Katsina State as source of water is drying up. This is as a result of unprecedented influx into irrigation farming which has exhausted the Jare River to its bed in Bakori, southern Katsina State. A study conducted by Ladan and Sule (2017), included shortage of water among the constraints to agricultural development in Bakori LGA. The study reported that irrigation along the Jare river has become difficult as farmers from both Bakori and Tsiga districts had to dig deep to reach the water table to collect water for irrigation. Another report by NTA (2017) indicate that more than 150 irrigation farmers using water from Musawa dam in central part of Katsina State have lost 30 million Nigerian Naira (about 85,714 US Dollars) following sudden drying up of the dam. Crops covering 150 hectares of tomatoes, potatoes, maize, wheat, onions and other vegetables were damaged as they became wilted forcing some farmers to commence early harvest to salvage what they could of the crops.

The present study examines shortage of water as a constraint to irrigation agriculture at Daberam dam site, northern Nigeria. The objectives of the study are to:

- Explain the importance of Daberam dam for irrigation farming in Katsina State
- Discuss the factors responsible for the shortage of water at the Daberam dam
- Explain the measures adopted by farmers to cope with the shortage of water
- Explain the implications of the water shortage to agricultural activities at Daberam dam site
- Highlight the efforts of the State Government towards overcoming the challenge of the shortage of water.

MATERIALS AND METHODS

Description of the Study Area

Daberam, the specific study area is the name of a village settlement in Daura LGA of Katsina State, northern Nigeria. Daberam is located on the geographical coordinates of latitude 12° 58'00" North of the equator and longitude 8°19'0" east of Greenwich (See figure 1)The village is located 16 kms off the Katsina – Daura Trunk A federal highway from the ancient town of Daura. The village is precisely located along the 26 km Fago to Dannakola road that is presently renovated by Katsina State Government.

In terms of population, the whole Daura LGA comprising Daura town, Daberam and other twenty (20) village settlements have a population of 224,884 persons according to the

final figures of 2006 census released by National Population Commission (Bawa, 2012). The inhabitants of the village are farmers, cattle rearers with a few engaging in trading activities in weekly markets within the northern parts of Katsina State and beyond. In terms of physical setting, the climate is part of the tropical continental climate region of northern Nigeria that is characterized by long dry season (September – April) and short wet season that lasts from May to August of every year. The area has an annual rainfall of 600 – 630mm mainly due to the area's location almost above latitude 13^{o} north of the equator (Abdullahi and Mukhtar,2015).The vegetation is Sudan savanna vegetation type consisting of very short grasses and shrubs with very thick barks (Alo *et al*., 1998). The few trees found are scattered in nature and one of the dominant is the neem tree (*Azadirachta indica*). The drainage of the area consists of rivers Kigo and Riniyal which serves as the main source of water for the Daberam dam and four streams that empty their waters in to the dam (See Figure 1)

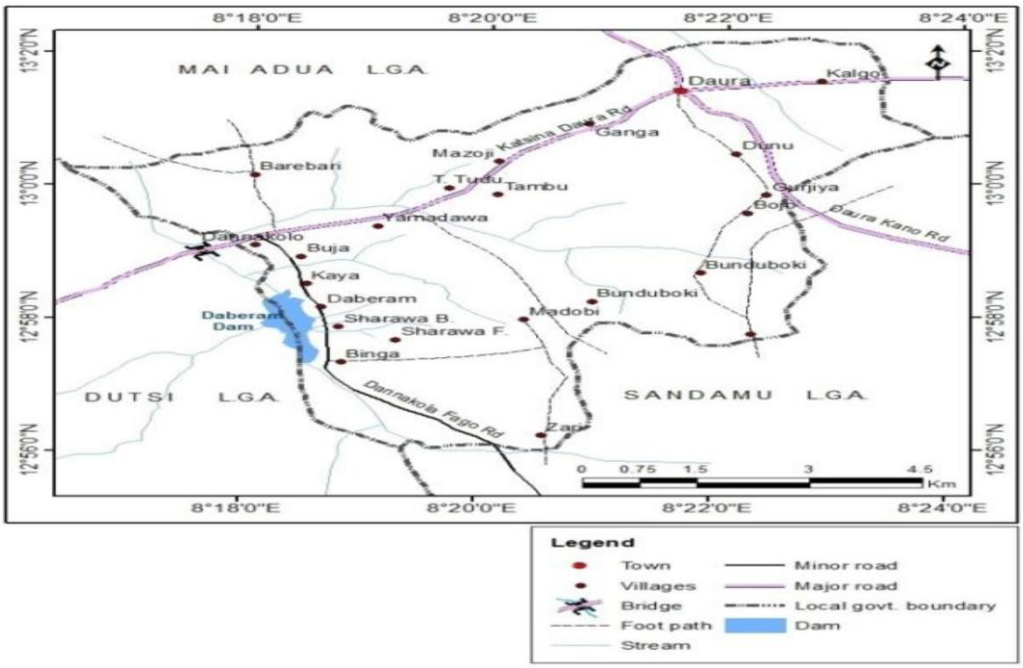

Figure1. *Map of Daura Local Government Area showing Daberam dam*

MATERIALS

A map in the book Katsina State Pictorial and Historical Sketches was used to identify Daura LGA, Daberam village and the dam, plus other village settlements. The map was photocopied and given to a Cartographer at Cartography Unit of the Department of Geography Umaru Musa Yar'adua Katsina to draw a more accurate map that indicates the coordinates, boundaries, drainages and correct labeling for the settlements. This map is used in the description of the study area and in interpreting the results and discussions of the study. A Fuji digital camera with optical lens zoom 5 x 50 mega fexel was used to snap a picture of the Daberam dam. This picture is incorporated into the study to show shortage of water at the dam site.

METHODS

The methods used to collect data for the research include structured questionnaire survey and direct observational technique. Two field visits to the dam site at Daberam and Sharawa Bugaje were held on 23rd June and 12th August, 2018. The structured questionnaire is prepared into two sections with one section aimed at collecting the demographic or socio-economic characteristics of respondents and the other section containing questions on water shortage in the dam. The questionnaire was administered on a total of sixty (60) farmers that use the dam water for irrigation, twelve each from five villages.

These farmers are those resident in the five village settlements that are located along the dam namely Binga, Sharawa Fulani, Sharawa Bugaje, Daberam and Kaya (See figure 1). Direct observation on the dam, irrigated farmlands and the physical setting of Daberam village was made also during the field visits. Secondary sources of data were collected through desk research from peer reviewed journal articles, textbooks, environmental reports and internet sourced materials.

RESULTS

The Importance of Daberam Dam to Irrigation Farming

The area covered by the Daberam dam is located between Daura and Dutsi LGA of Katsina State. Large part of the dam is located in Daura LGA hence the dam is considered to be in the local government area. The dam has the capacity of 30.1 million cubic meters covering 400 hectares of land but because of siltation only 200 hectares is fully being utilize (Bala *et al*., 2009). The dam has a crest length of 2377.44 meters and its deepest point is 42.6 meters which base on these figures and in comparison to other dams in the State, the dam is a medium size dam (Abdulrahman and Zango, 2015). At its full capacity the dam's spill-over even use to support Sabke dam located in Mashi and Mai'adua LGAs (Bala and Abdullahi, 2011). The type of irrigation system been used is surface lift for the production of mainly vegetables and some cereal crops such as wheat and rice. Respondents have listed nine villages that use the Daberam dam water for irrigation on the Daura side of the dam which are Binga, Daberam, Dannakola, Gyarce, Kaya, Sharawa Bugaje, Sharawa Fulani, Turumni and Zari. On the Dutsi side five villages were listed which are Haukan Zama, Madawa, Makangara, Nareje and Ruwan Kaya. .Daberam dam has been the center for irrigation farming of Daura LGA since 1980 when the dam was handed over to Katsina State Government by the late Emir of Daura Alhaji Muhammad Bashar. People especially the youths are trained at Tambu Agricultural Training Center and encouraged to engage in dry season farming and fishing using the Daberam dam (Bawa,2012) .In October 2010,the then Governor of Katsina State Alhaji Ibrahim Shehu Shema launched the years fertilizer sale to irrigation farmers at the Daberam Dam site and also inspected some areas of land under irrigation around the dam (The Smash,2011) The other uses of the dam besides irrigation include fishing activities and watering of livestock. Fish farming was introduced by the then Governor of Katsina State, Alhaji Umaru Musa Yar'adua in all the 34 LGAs of the State in the year 2005 as one of the measures towards diversifying the economic base of the State and Daberam serve as the fish farming Centre for Daura LGA. Most of the fish caught at the Daberam dam are transported to Dannakola village just 4kms away from Daberam where the fish is fried and sold to travelers along the Katsina –Daura road. In March 2018 students studying National Diploma in Fisheries Technology visited the Daberam dam fishery center as part of their practical for the programme.. The present State government has constructed a water treatment plant at the dam site for proposed semi-urban water supply to Daura town.

Figure2. *The Daberam dam heavily silted with little water contained in it.*

Socio-Economic Characteristics of the Respondents

The socio-economic characteristics (Table 1) of the respondents indicate that in terms of gender all (100%) of the respondents are males. This is base on the culture of the people in the study area where men engage in farm work to supply food to the family. In terms of age it showed that 25.5% each of the respondents are within

the age range of 20-29 years and 30-39 years. The respondents within the age range of 40-49 years constitute 33.4% and those within the age of 60-69 years constitute 16.6% of the respondents. This showed that even at older age of 60 years and above some of the respondents is still actively engaged in farming. The marital status of the respondents indicates that large percentage (83.4%) of the respondents are married and therefore engaged in farming to feed their families.

Those that are not married and therefore single constitute only 16.6% of the respondents. Among those that are married, the number of children born from the marriage differs as 41.5% each had one to four and five to nine children. The percentage of those that had ten to fourteen children constitutes only 16.6% of the respondents. In terms of educational qualification 41.5% of the respondents have no formal education but had Islamic education. The percentage of those with primary school education is 16.6% which combined with those with no formal education will give a figure of 58.1% which indicates low literacy level in the study area.

Those respondents with secondary school education constitute 33.2% and those that have acquired tertiary level education constitute only 8.3% of the respondents. The occupational status of the respondents showed that all (100%) of the respondents are engaged in both rain-fed and irrigation farming. This means that the respondents are fully engaged in farming activities during both the rainy and dry seasons. Besides farming large percentage (83.4%) of the respondents are also engaged in other auxiliary occupations to support or diversify their sources of income.

These occupations include cattle rearing, trading activities, and tailoring services, charging of GSM phone, operating commercial motorcycles and blacksmithing to provide farm tools and implements. Only 16.6% of the respondents do not engage in any occupational activity besides farming. The occupational characteristics of the respondents clearly indicate that the respondents of the study area are hard working people that engage in various economic activities to support themselves, their families and the community at large. This shows why the people are concerned about the shortage of water in the dam which can make them redundant during the dry season. The socio-economic characteristics of the respondents can be seen on the table below.

Table1. *Socio-economic characteristics of the respondents*

Characteristic	Frequency	Percentage (%)
Gender		
Male	60	100%
Female	-	-
Age range		
20-29 years	15	25.0%
30 – 39 years	15	25.0%
40 – 49 years	20	33.4%
50 -59 years	-	-
60 years and above	10	15.6%
Marital status		
Single	10	16.6%
Married	50	83.4%
Number of children		
One – four children	25	41.5%
Five – nine children	25	41.5%
Ten – fourteen children	10	16.6%
Educational qualification		
No formal education	25	41.5%
Primary school	10	16.6%
Secondary school	20	33.2%
Tertiary level	05	08.3%
Occupational status		
Rain fed farming	-	-
Irrigation farming	-	-
Both rain fed and Irrigation farming	60	100%
Additional occupation		
Yes	50	83.4%
No	10	16.6%

Shortage of Water at the Daberam Dam Site

Large percentage of the famers (78%) have observed the shortage of water in the dam in the last ten years, that was from the year 2008 while small percentage of the farmers (22%) observed the shortage of water in the last eight years, that was from the year 2010.Since the year 2008 when majority of the farmers observed the shortage of water in the dam, the farmers then complained to the then Government of Alhaji Ibrahim Shehu Shema. A team of officials were sent to assess the situation but no work was started towards rehabilitating the dam up the end of the administration in May 2015. The factors responsible for the shortage of water as noted by the respondents are:

Construction of Other Dams

The Daberam dam is one of the oldest dams in Katsina State that was established by the North Central Regional Government in 1963 when the population of northern Nigeria is less than the

figures obtained today. Over the last 40 years, the population of the northern region has grown, more farmlands were created and more food needs to be produced by irrigation to feed the rapidly expanding population. The result is the creation of several dams along streams and rivers that supply water to the Daberam dam. These dams include Rijiyar Tsamiya and Dutsi dams in Katsina State, Thomas Dam in Dambatta LGA Kano State, Kazaure Dam in Kazaure LGA Jigawa State, Gari dam in Kunchi LGA Kano State. The construction of these dams seriously reduces the amount of water that flows into the Daberam dam. Respondents even recalled that in the year 2006, the Daberam dam was containing too much water after heavy downpour of rain that it busted along its spillway but at that time the Dutsi and Rijiyar Tsamiya dams were not constructed.

Silting of Tributary Streams

The four streams that supply water to the dam have also silted and therefore they contain very little amount of water. During the rainy season, these streams bring only sand to the dam which further increases the level of siltation at the dam. Small amount of water is brought by the streams during the rainy season which means the water level does not rise appreciably. The silting of the streams with sand particles occurs primarily because of the location of the study area close to the Sahara desert in the neighboring country of Niger Republic. A study by Inkani and Mashi (2017) observed the silting of the tributary streams feeding the dam which have reduced the water volume and affects negatively the use of the dam.

Silting of the Dam

Since the construction of the dam in 1963, the dam was never rehabilitated and with time there was the gradual siltation of the dam. Also the streams that feed the dam have over the years been feeding the dam with mostly sand particles and little water leading to gradual silting of the dam. The situation reduces the amount of water that the dam can contain which leads to shortages for irrigation farmers at the dam site. A recent study by Abdulrahman and Zango (2015), observed that the dam is heavily silted and urgently need rehabilitation to improve water supply from the dam.

Insufficient Rain

The study area of Daberam and Daura LGA has been recording insufficient rainfall in the last few years. Even though there are no adequate reliable records on the amount and duration of rainfall in the study area. The eighty two percent (82%) of the farmers have observed the decline in the amount of rainfall received in the region particularly during the 2017 rainy season. The rain also adds to the amount of water in the dam directly and it runs off into the streams that supply water to the dam. The annual rainfall amount of 600 – 630mm is one of the lowest in the country which arises due to the areas location around latitude 13^{o}N which are susceptible to the occurrence of drought conditions due to climate change (Babatolu, 2018).

How the Farmers Cope with the Shortage of Water

The farmers at the irrigation site have adopted a number of ways in order to cope with the situation which include:

Rationing of Water

This is the strategy of allowing a particular group of farmers to draw water from the dam and use it for the irrigation of their farmlands on a given day and the next day is the turn of other group of famers. Forty two percent (42%) of the farmers adopt this strategy of coping with the water shortage at the dam site. The rationing of the water of the dam is possible as a result of the cordial relationships between the inhabitants of Daberam and the surrounding villages.

Digging of Wells

Other farmers constituting thirty eight percent (38%) of the respondents resorted to digging wells and the water is then used for irrigation. Agricultural Extension agents deployed by the State Government teach the farmers how to construct wells in a favorable location within their farmlands for irrigation purposes. However, the farmers observed that there is low level of water in the wells and the water collected does not flow far to irrigate large area of land, only small patches of land. This effectively means that the farmers could only irrigate small pieces of land and get limited produce.

Abandoning of Irrigation Farming

Twelve percent (12%) of the respondents have abandoned irrigation farming at all due to the shortage of water. Some of them now rely totally on rain-fed farming and rearing of cattle while others have resorted to engage in trading activities that involve buying and selling commodities at the local markets in local

government areas around Daura up to Jigawa State. This can be observed from the demographic characteristics of the respondents where 83.4% engage in auxiliary occupations besides irrigation farming to augment their sources of income and livelihoods.

Migration to Nearby Dams

Eight per cent (8%) of the respondents have migrated to other dam sites to engage in irrigation farming. These nearby dams are Sabke dam in Mai'adua LGA, Dutsi dam in Dutsi LGA and Rijiyar Tsamiya dam in Sandamu LGA. The migration of irrigation farmers to nearby dams is a common measure adopted by farmers in Katsina State .For example after the collapse of the Kankia dam in Kankia LGA in the year 2013, some farmers migrated to the nearby Sagawa dam and continue their irrigation activities (Ladan, 2015).

DISCUSSION

Implication of the Water Shortage to Agricultural Activities

Low Crop Productivity

The shortage of water for irrigation has resulted in low productivity as some crops could not grow well to bear seeds such as tomatoes and pepper. Many farmers could not get bumper harvest since the shortage of water was noticed. In addition to this, the cultivation of rice was stopped by the farmers as the crop requires a lot of water which could not be obtained due to the shortage.

Psychological Stress to the Crops

The irrigated corps planted on the farmlands show clear symptoms of psychological stress due to the shortage of water. Crops such as cabbage, lettuce and vegetables could not grow well and be productive so that they are harvested. The respondents in particular observed that vegetables such as pepper shrink and later dried due to the shortage of water from the dam for irrigation activities.

Loss of Employment Opportunities

The shortage of water at the Daberam dam site has greatly reduced farming activities which provide source of employment to many people from within and outside the LGA. This represents loss of employment opportunities, as few people are found engaging in the farming activities due to the water shortage. In fact, both rain fed and irrigation farming provide employment opportunities to large number of people at Daberam and the surrounding villages and the shortage of water has reduced the number of those that are employed in irrigation farming.

Loss of Fishing Grounds

The Daberam dam at its full capacity use to be a rich fishing ground where variety of fishes are caught and sold at the Dannakola fish stalls located 4kms away. But with the reduction in the volume of water and limited water brought from feeder streams there is loss of fishing grounds as few fishes are found in the remaining water. This has affected commercial fishing activities that are carried on the dam as noted in the study by Inkani and Mashi (2017). The study also reported that less fish is now caught on the streams that are feeding the dam as they contain less water.

Inadequate Cattle Watering Points

The Daura LGA and surrounding LGAs are noted for high population of cattle. Most of the cattle roam the areas of the LGA in search of pasture grass and water points. Therefore, the Daberam dam is one of the water bodies where there are large concentrations of cattle on the difference sides of the dam. However, with drop in the water contained in the dam, there are inadequate cattle watering points to share the limited spaces along the dam that contain water.

EFFORTS OF KATSINA STATE GOVERNMENT TOWARDS OVERCOMING THE SHORTAGE OF WATER

The farmers at the Daberam dam have complained about the water shortage to the State government when the present State Governor Alhaji Aminu Bello Masari came to Daura LGA for a visit to inspect renovation of the Daura Motel in the year 2016. Base on this complain, the State government has taken a number of measures towards overcoming the shortage of water in the dam which include

Rehabilitation of the dam

In the year 2017, the State government has approved N300 million (about 85,714 US Dollars) for the rehabilitation of the Daberam dam in Daura senatorial zone and Ruwan Sanyi dam in Funtua senatorial zone (NAN, 2017). The contract execution has already begun and the State Governor has visited the contract site to inspect the progress of the work in January 2018. Field visit in June and August 2018 has shown that the rehabilitation work is not making progress and the local people are not satisfied

with the company that is awarded the contract. They however hoped for speedy completion of the contract which will allow the dam to contain more water to permit full scale irrigation and fishing activities.

Establishment of Agro-Meteorological Station

This station was established at Daura with automatic weather station that will record rainfall, temperature, winds etc. that will provide data to guide farming activities in the study area. It is also expected that the data so collected can be used to make the area climate change resilient (Daily Trust, 2017). The establishment of the station will augment the indigenous knowledge of the farmers about their environment and climate needs for agricultural decision making with the climate data collected (Babatolu, 2018).

Extension Agents

The State Government has deployed agricultural extension agents to the Daberam dam site. The extension agents are to advise farmers on the judicious use of available water to avoid leakages and wastages during irrigation. They also advise farmers to engage in planting trees as a measure to stimulate rainfall and improve the environment around the dam. A study by Lawal *et al* (2015) on the role of extension workers in irrigation farming in Katsina State has established that there is strong relationship that exists between irrigation farmers and extension workers through the dissemination of agricultural knowledge and supporting systems.

Conclusion

The Federal Government of Nigeria is shifting emphasis on developing the enormous potentials in agriculture as a viable alternative towards diversifying the nation's economy due to dwindling oil revenues from the international market (Ladan and Sule, 2017). In view of this a number of dams owned by the Federal Government of Nigeria are presently undergoing rehabilitation across northern Nigeria to boost their water retention capacity to improve irrigation farming such as the Sabke dam in Mai'adua LGA. The Federal Government has also reconstructed Maska earth dam in Funtua LGA to provide adequate water for irrigation farming and other basic needs of the communities. Katsina State Government has followed suit by also embarking on rehabilitation of the dams it owns to overcome the challenges facing them such as shortage of water in the case of Daberam dam The efforts of the Katsina State Government are acknowledged and appreciated. However, all the respondents to the questionnaire survey have observed that the pace of the rehabilitation work is moving slowly which might affect the work in view of the coming of rainy season. It is hope that by the time the rehabilitation project is completed that the remaining 200 hectares of land initially projected for the dam will be fully utilized for irrigation farming.

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